

3. AFFECTED ENVIRONMENT

3.1 PORTSMOUTH GASEOUS DIFFUSION PLANT

PORTS is located approximately 35 km (22 miles) northeast of Portsmouth in Pike County, Ohio, and occupies 3714 acres. Construction of the site began in late 1952 and ended in 1956, one year after the start of uranium enrichment processing at the site. On July 1, 1993, DOE leased portions of PORTS to the United States Enrichment Corporation (USEC) to manage and operate the uranium enrichment enterprise. DOE retains responsibility for the unleased portions of the site, which consist primarily of environmental restoration and waste management activities.

3.1.1 Human Health

The radiation dose from airborne radionuclides to a maximally exposed individual was 0.260 mrem, and the collective radiological dose from airborne emissions to the site region of influence (ROI) health risk population was 3.0 person-rem (DOE 1997a).

3.1.2 Climate and Air Quality

Prevailing winds at PORTS are from the south to southwest, with the south averaging the highest at just over 11% of the time. Wind speeds average 5 mph, with winds up to 75 mph on record. The average annual temperature measured at the site in 1992 was 55°F (DOE 1997a), with 112 days/year at or below 32°F in the winter with only 27 days/year at or above 90°F in the summer (MMES 1991).

Pike County is classified by the U.S. Environmental Protection Agency (EPA) as an attainment area for all six National Ambient Air Quality Standards (NAAQS) criteria air pollutants. The major sources of criteria pollutant emissions are three coal-fired boilers at the X-600 steam plant. Sources of radionuclide and fluoride emissions include purge cascade vents, cold recovery and wet evacuation vents, the X-344 evacuation vent, and six seal exhaust vents.

3.1.3 Water Resources

Surface Water

Major surface water features include the Scioto River and its on-site tributaries – Little Beaver Creek and Big Run Creek. There are no federally designated Wild and Scenic Rivers in the ROI. The Scioto River and an alluvial aquifer supply water to the site, and the on-site streams and Scioto River receive treated wastewater. The site is located outside the 500-year floodplain.

Groundwater

Major groundwater units include the Mississippian shale and sandstone bedrock aquifer and the unconsolidated sediment aquifer.

3.1.4 Geology and Soils

The site is on gently rolling land about 40 m (130 ft) above the Scioto River and 204 m (670 ft) above sea level. The predominant landform in the area is a relatively level, filled valley of the preglacial Portsmouth River, which runs north to south. Major rock units include, from oldest to youngest, the Ohio Shale, the Bedford Shale, the Berea Sandstone, the Sunbury Shale, and the Cuyahoga Shale. The site is in an abandoned

river valley filled with fluvial materials. The soils in the fenced area are mostly urban land covered by roads, parking lots, buildings, and railroads. Other soils are well-drained upland soils. No major geologic faults exist in the ROI, and the potential for volcanic activity is small.

3.1.5 Ecological Resources

Vegetation consists of pastureland, old fields, oak-hickory, upland mixed hardwood, bottomland mixed hardwood, pine, second-growth hardwood, and scrub thicket. All forests and old fields are second growth. There are 45 wetlands totaling 13.9 ha (34.36 acres) at PORTS (DOE 2001a). The federally protected, endangered Indiana bat has been identified in the vicinity of the site, but no threatened or endangered species have been located on-site. Several state-listed species are known for the vicinity but none presently on-site. The sharp-shinned hawk, Carolina yellow-eyed grass, Virginia meadow beauty and rough green snake have been found on-site in the past.

3.1.6 Socioeconomics and Environmental Justice

Socioeconomics

The PORTS ROI includes both Pike County, where the facility is located, and Scioto County, which includes Portsmouth, the nearest city. Table 3.1 summarizes population, per capita income, and total person income for both counties from 1999, the last year for which figures were available. Total personal income was more than \$2 billion (U.S. Bureau of Economic Analysis 2002a). Combined wage and salary employment for the region was nearly 39,817 in 2000 (U.S. Bureau of Economic Analysis 2002b). Total site employment in 1998 was 2700 (DOE 2002a).

Table 3.1. Population, income, and employment in the PORTS region of influence for Pike County and Scioto County

Region/Variable	Pike County	Scioto County
Population	27,988	80,533
Per capita personal income (\$)	18,353	18,978
Total personal income (million \$)	514	1,524

Environmental Justice

There are no federally recognized Native American tribes in the ROI. There are no minority populations within a 32-km (20-mile) radius of the PORTS site. However, the vast majority of a 32-km (20-mile) radius of the plant has low-income populations (based on population proportions greater than the national average of 13.1%).

3.1.7 Land Use

The site covers approximately 6.3 mile² (4003 acres), of which 800 acres are developed and 3203 acres are undeveloped. Of the land that is undeveloped, nearly all is available for future site development. Land use surrounding the site is predominantly rural.

3.1.8 Infrastructure

One on-site facility and 31 off-site wells provide an average of 14 million gallons of water per day. An on-site facility receives an average of 0.35 million gallons of sewage per day. The Ohio Electric Corporation

supplies power via an electrical and coal-fired system; the historical load is over 1500 MW and 4500 tons of coal/month use; however, the current load is less than 100 MW/month. Transportation in the region consists of local access roads (such as Piketon Hill Road and State Route 32) and major roads (such as Interstate 70 and U.S. Highways 23, 52, and 50). The Chesapeake & Ohio Railroad and the Norfolk & Western Railroad are the primary providers of rail service to the PORTS region.

3.1.9 Cultural Resources

A 1997 archaeological survey identified 39 archaeological resources, which includes prehistoric components, isolated finds, and lithic scatters. A couple of resources contain prehistoric and historic components; another is a prehistoric, isolated find in a historic cemetery; another is a prehistoric lithic scatter and a lithic scatter in a historic farmstead (DOE 2002). Two architectural historic surveys have been completed at PORTS, and several structures have been identified that may have historical significance (DOE 2002).

3.2 PADUCAH GASEOUS DIFFUSION PLANT

The PGDP Reservation covers 3425 acres in western Kentucky, 17 km (10 miles) west of Paducah, and employs 1868 people. Paducah has been an active uranium enrichment facility since 1952. Enriched uranium is produced by the USEC for the commercial sector as fuel for nuclear power reactors in the United States and overseas. PGDP was a feed facility for PORTS.

3.2.1 Human Health

The radiation dose from airborne radionuclides to the maximally exposed individual was 0.0045 mrem, and the collective dose from radionuclide emissions to the site ROI health risk population was 0.017 person-rem. The ROI population was estimated at 500,502 based on 1990 census data.

3.2.2 Climate and Air Quality

The average prevailing wind in the area is from south to southwest at approximately 16 km/h (9.8 mph). Generally stronger winds are observed when winds are from the southwest or northwest (DOE 2000). January is the coldest month, with a daily average temperature of 35°F, while July is the warmest month with an average temperature of 79°F.

McCracken County is classified by the EPA as a marginal attainment area for ozone. The county is in attainment for the other criteria pollutants. The major sources of criteria air pollutant emissions are coal-, oil-, and gas-fired boilers. Sources of radionuclide emissions in 1997 were the cascade purge vent/stack at the C-310 purge and products building, decontamination activities at the C-400 cleaning building, and emissions from laboratory hoods in the C-710 building.

3.2.3 Water Resources

Surface Water

Major surface water features include the Ohio River, which is less than 3 km (2 miles) from PGDP, Metropolis Lake [2.4 km (1.5 miles) northeast], and two small tributaries to the Ohio River (Big Bayou Creek and Little Bayou Creek) that provide surface drainage to the site. There are no federally designated Wild and Scenic Rivers in the ROI. The site is above the probable 500-year flood level. The site receives fresh water from the Ohio River, and both the two on-site streams and the Ohio River receive treated wastewater from the site.

Groundwater

Major groundwater units include, from bottom to top, the McNairy Flow System (interbedded sand, silt and clay), the terrace gravels, the Regional Gravel Aquifer (the primary aquifer in the area, composed of sand and gravel units), and the Upper Continental Recharge System (clayey silt with interbedded sand and gravel). No aquifers are considered sole-source aquifers. Two major plumes of groundwater contamination extend off-site.

3.2.4 Geology and Soils

The topography slopes slightly from more than 137 m (450 ft) in the southern part of the site to near 91 m (300 ft) near the Ohio River. Surface sediments consist of valley fill deposits, which underlie most of the site, extending northward to the Ohio River. Major rock units include, from oldest to youngest, basement rocks, Tuscaloosa Formation basal gravels, the McNairy Formation, the Porters Creek Clay, continental deposits of gravel and clay-sand units, and a 10- to 30-ft layer of loess (windblown sediment). Soils beneath the site are nearly level and somewhat poorly drained. Geologic hazards include the potential for earthquakes. The site is near two active seismic zones, the New Madrid Fault Zone and the Wabash Valley Fault Zone. The potential for volcanic activity is small.

3.2.5 Ecological Resources

Nonforested areas consisting of mowed grass and developed area cover most of the Paducah site; forested areas are small and dominated by mature hardwood upland and riparian forests. On-site wetlands consist of forested wetlands (mature riparian hardwood forest). A wetland in the West Kentucky Wildlife Management Area (the buffer area surrounding the production facilities) has been designated an area of ecological concern.

Federally listed endangered species that have been identified, or could be identified, in the vicinity of the Paducah site include the Indiana bat, the interior least tern, and four species of pearly mussels. Another species of pearly mussel is federally listed as threatened, as is the bald eagle. No federally listed plant species are known to occur in the vicinity of Paducah.

3.2.6 Socioeconomics and Environmental Justice

Socioeconomics

The Paducah ROI includes McCracken County, Kentucky, where the facility is located. McCracken County had a population of 64,407, per capita personal income of \$23,227, and a total person income of \$1.8 billion in 1999 (U.S. Bureau of Economic Analysis 2002a). Wage and salary employment for the region was more than 41,859 in 2000 (US Bureau of Economic Analysis 2002b). Total site employment in 1998 was 2209 (DOE 2002b).

Environmental Justice

There are both low-income and minority populations near the plant site, with minority populations in the city of Paducah. There are no federally recognized Native American tribes in the area.

3.2.7 Land Use

The site occupies approximately 3425 acres, of which 750 acres are developed and 2675 acres are undeveloped. Land use surrounding the site is predominantly undeveloped natural area.

3.2.8 Infrastructure

The Ohio River supplies an average of 15 million gal of water per day; the water is treated on-site by chemical and physical processes. An on-site treatment plant receives an average of 0.2 million to 0.4 million gal of sewage per day. Sewage is treated on-site. Electric Energy, Inc., supplies power; the current site load is 1564 MW. The site also uses approximately 82 tons of coal per day. Transportation in the region consists of local access roads (State Routes 1154 and 358) and major roads (Interstate 24 and U.S. Highways 45, 60, and 63). The Burlington Northern Railroad, Paducah Railroad, Louisville, and the on-site U.S. Government Railroad are primary providers of rail service to the Paducah region.

3.2.9 Cultural Resources

The site has three recorded archaeological or historic sites, and others have been identified in areas near the Paducah plant site. The site has not been subject to any systematic cultural resources surveys.

3.3 Y-12 NATIONAL SECURITY COMPLEX

The Y-12 Complex (formerly the Y-12 Plant) is one of three installations on the DOE Oak Ridge Reservation (ORR). The early missions of the site included separation of ^{235}U from normal uranium by the electromagnetic separation process and manufacturing weapons components from uranium and lithium (DOE 2001b).

During 2000, the U.S. Congress established the National Nuclear Security Administration (NNSA). Its mission is to carry out National Security responsibilities of DOE (DOE 2001).

3.3.1 Human Health

The calculated radiation doses to maximally exposed off-site individuals from airborne releases from all sources on the ORR were 0.40 mrem (ORNL 2001). The collective radiological dose from airborne radionuclide emissions to the site ROI health risk population was 43 person-rem (DOE 1997a).

3.3.2 Climate and Air Quality

The climate of eastern Tennessee may be broadly classified as humid continental, although it is very near the region of temperate continental climate to the north. The Cumberland Mountains/Plateau to the northwest and the Great Smoky Mountains to the southeast influence the patterns of temperature and precipitation over the region, with cooler temperatures and greater precipitation generally occurring at the higher elevations. The average annual temperature in Oak Ridge, based on a 30-year period from 1961 to 1990, is 56.6°F, and precipitation is 136.7 cm (53.8 in.) per year. Precipitation is fairly evenly distributed most of the year. The average wind speed is approximately 4 mph (at 10 m above the ground), and the highest wind speed, 79 mph, was associated with a tornado in Bear Creek Valley during the afternoon of February 21, 1993. Prevailing wind directions are from the northeast and southwest, reflecting the channeling of winds parallel to the ridges and valleys in the area.

The air quality control region in which the Y-12 Complex is located is in attainment for NAAQS criteria pollutants. The nearest nonattainment area is Polk County, which is about 64 km (40 miles) south of the Y-12 Complex. Air quality in the region is generally good. However, the ozone standard is occasionally exceeded per monitoring data from Anderson County (DOE 2001b).

The release of radiological contaminants, primarily uranium, into the atmosphere at the Y-12 Complex occurs almost exclusively as a result of plant production, maintenance, and waste management activities (ORNL 2001). In 2000, only 9.16×10^{-3} curies of uranium (2.2 kg) were released from the Y-12 Complex (ORNL 2001). Measurements at the perimeter of the ORR indicate ambient air concentrations are less than 1% of their respective derived concentration guidelines (DCGs) given in DOE Order 5400.5 (DOE 1997a). A DCG is a concentration of a given radionuclide for one exposure pathway (e.g., inhalation) that would result in an effective dose equivalent (EDE) of 100 mrem per year to a reference individual, as defined by the International Commission on Radiological Protection.

The prevention of significant deterioration (PSD) Class I area nearest to the Y-12 Complex is the Great Smoky Mountains National Park, approximately 48 km (30 miles) south of the facility. The Joyce Kilmer Wilderness Area, which is also a Class I area, is just south of the western end of the Great Smoky Mountains National Park. The median visibility range at the park is 39 km (24 miles), with a summer median of 19 km (12 miles).

3.3.3 Water Resources

The Y-12 Complex is approximately 3 km (2 miles) from the Melton Hill Reservoir and Clinch River. On-site, two streams originate approximately in the middle of the plant. Bear Creek flows directly west from its headwaters at the Y-12 Complex, while East Fork Poplar Creek flows east before turning north and west and flowing through the residential area of Oak Ridge. These two creeks merge near ETTP, which is approximately 16 km (10 miles) west of the Y-12 Complex. The major groundwater unit for the ORR is the Knox Aquifer, composed of the Knox Group and the Maynardville Limestone. No aquifers are considered sole-source aquifers (DOE 1997b).

3.3.4 Geology and Soils

On a regional scale, the ORR, which includes the Y-12 Complex, is located on the western part of the Valley and Ridge Province (DOE 1998a). The stratigraphic section of the ORR is stacked along three major thrust faults. The eastern portion of the Y-12 Complex is located on the White Mountain thrust sheet. This fault has not been historically active (DOE 1998a).

Bear Creek Valley, to the west, is underlain by rocks of three regionally important stratigraphic units: the Rome Formation, the Conasauga Formation, and the Knox Group, which typically dip 45° to the southeast (DOE 1997b). The geology of Bear Creek Valley displays an inclined layer, cake-style stratigraphy that is observed on a variety of scales: on a regional scale, where limestone- and dolomite-dominated rock groups are interbedded with predominantly clastic shale groups, and on the scale of outcrops, where clastic beds are interlayered with carbonate beds. This layered structure exerts a strong influence on groundwater flow (DOE 1997b).

3.3.5 Ecological Resources

The ORR consists of diverse habitats and supports a rich variety of flora and fauna. Vegetation is characteristic of that found in the intermountain regions of central and southern Appalachia. The Y-12 Complex is covered in mowed grass, concrete, gravel, asphalt, and industrial structures. Thus, the site does not have unique habitats or a wide diversity of flora or fauna. Upper East Fork Poplar Creek lacks riparian vegetation because much of the stream is channelized and maintained. Lake Reality is a 2.5-acre, plastic-lined, flat-bottomed settling and spill control structure located near the east end of the facility on East Fork Poplar Creek.

There are no federally protected threatened or endangered species known on the Y-12 Complex. However, the U.S. Fish and Wildlife Service (FWS) notes that the federally listed endangered species—the gray bat (*Myotis grisescens*), the Indiana bat (*Myotis sodalis*), and the pink mucket (*Lampsilis abrupta*)—are known from, or have the potential to occur within, the project impact areas on the ORR. A Biological Assessment has been prepared covering these three species for the ORR (see Chapter 7). Although surveys for protected species are not comprehensive enough to rule out all possible federal- or state-listed vertebrates, the likelihood of finding such species seems very low (DOE 1998a).

There is a small wetland (0.45 acre) in a small, wooded area between New Hope Cemetery and Bear Creek Road.

3.3.6 Socioeconomics and Environmental Justice

The Y-12 Complex is one of three sites located on the DOE ORR, which includes portions of both Anderson and Roane counties in Tennessee. This region also includes the city of Oak Ridge, which provides a substantial portion of the work force for the three facilities. To generate the most conservative estimates of potential impact, the ROI includes only these two counties. Actual impacts are likely to be distributed over a wider area, since Anderson County is also part of the metropolitan statistical area for the much larger city of Knoxville and draws commuters from at least 12 counties in eastern Tennessee.¹

Table 3.2 summarizes population, per capita income, and total personal income from 1999 (U.S. Bureau of Economic Analysis 2002a). Total personal income was more than \$2.8 billion. Wage and salary employment for the region was 60,311 in 2000 (U.S. Bureau of Economic Analysis 2002b). The Scarboro Community, which borders the fenceline of the plant’s northern boundary, is predominantly an African-American community.

Table 3.2. Population and income in the Y-12 National Security Complex Region of Influence for Roane and Anderson Counties for 1999

Region/variable	Roane County	Anderson County
Population	50,008	71,004
Per capita personal income (\$)	21,728	25,548
Total personal income (million \$)	1,087	1,788

3.3.7 Land Use

The Y-12 Complex is an industrial site that has been in operation since World War II. The residential portion of Oak Ridge forms much of the northern boundary to the site, and the Tennessee Valley Authority’s (TVA’s) Melton Hill Reservoir and the Clinch River are located to the south and west. Recreational uses of the surrounding area include fishing, boating, hunting, swimming, and camping. Several recreational areas are within 8 km (5 miles) of the site.

3.3.8 Infrastructure

Sanitary wastewater from the Y-12 Complex is discharged to the city of Oak Ridge publicly owned treatment works under an industrial and commercial wastewater discharge permit. Sanitary sewer radiological sample results at the Y-12 Complex are routinely reviewed to determine compliance with DOE Order 500.5, “Radiological Protection of the Public and the Environment.” No radiological parameter that is monitored (including uranium) has exceeded a DCG (ORNL 1998). Typically, sample results indicate the Y-12 Complex

¹Commuting data taken from Oak Ridge Chamber of Commerce website, www.orcc.org/labor.html.

radiological discharges are three orders of magnitude below their respective DCGs (ORNL 1998). During 2000, the wastewater flow averaged about 670,000 gal/day (ORNL 2001).

3.3.9 Cultural Resources

Native American occupation of the Oak Ridge area began about 12,000 years ago. European settlement began in the 18th century. Much of the current Y-12 Complex was farmed before World War II, when the site was secured by the federal government as part of the Manhattan Project. A cultural resources survey conducted in February 1995 identified an historic district with 92 contributing structures and 53 noncontributing structures and 4 structures not contiguous with the historic district that are eligible for inclusion in the National Register of Historic Places (NRHP) (Sousa et al. 2001).

3.4 EAST TENNESSEE TECHNOLOGY PARK

ETTP, formerly known both as the Oak Ridge Gaseous Diffusion Plant and as the Oak Ridge K-25 Site, is located in Roane County, Tennessee, and is one of three large facilities on the ORR. The site is located on a level, 1500-acre tract of land near the confluence of Poplar Creek and the Clinch River. ETTP is approximately 56 km (35 miles) west of Knoxville and approximately 13 km (8 miles) southwest of the city of Oak Ridge.

3.4.1 Human Health

The calculated radiation doses to maximally exposed off-site individuals from airborne releases from all sources on the ORR were 0.40 mrem (ORNL 2001). The collective radiological dose from airborne radionuclide emissions to the site ROI health risk population was 43 person-rem (DOE 1997a).

3.4.2 Climate and Air Quality

The climate of eastern Tennessee may be broadly classified as humid continental, although it is very near the region of temperate continental climate to the north. The Cumberland Mountains/Plateau to the northwest and the Great Smoky Mountains to the southeast influence the patterns of temperature and precipitation over the region, with cooler temperatures and greater precipitation generally occurring at the higher elevations. The average annual temperature in Oak Ridge, based on a 30-year period from 1961 to 1990, is 56.6°F and precipitation is 136.7 cm (53.8 in.) per year. Precipitation is fairly evenly distributed most of the year. The average wind speed is approximately 4 mph (at 10 m above the ground), and the highest wind speed, 79 mph, was associated with a tornado in Bear Creek Valley during the afternoon of February 21, 1993. Prevailing wind directions are from the northeast and southwest, reflecting the channeling of winds parallel to the ridges and valleys in the area.

Roane County and all surrounding counties are in attainment for NAAQS criteria pollutants. The nearest nonattainment area is in Polk County, about 72 km (45 miles) south of ETTP. Air quality in the region is generally good. The ozone standard is occasionally exceeded in Knoxville; however, Knox County is in attainment of the ozone standard.

The PSD Class I area nearest to ETTP is the Great Smoky Mountains National Park, 56 km (35 miles) south of the facility. The Joyce Kilmer Wilderness Area, which is also a Class I area, is just south of the western end of the Great Smoky Mountains National Park. The median visibility range at the park is 39 km (24 miles), with a summer median of 19 km (12 miles).

3.4.3 Water Resources

Surface Water

ETTP is directly adjacent to the Clinch River along the northwest boundary of the ORR. Poplar Creek is a moderately wide (30- to 70-ft) stream that enters the north side of ETTP about 0.5 km (0.3 mile) downstream of the confluence of the east and west forks of Poplar Creek. The lower reach of Poplar Creek meanders sharply along the southwest side of ETTP and enters the Clinch River.

TVA performed an analysis of floods on the Clinch River and Poplar Creek. TVA concluded that most of ETTP is above the probable maximum flood level. The only facilities identified at risk during major floods were the K-25 power plant and the pumping station for ETTP's water filtration plant. The source of flooding at ETTP would be backwater from the Clinch River near the confluence of Poplar Creek. All proposed storage locations are above the 100-year flood level.

Groundwater

Groundwater occurs at ETTP in both the unconsolidated overburden and underlying bedrock as a single, unconfined water table aquifer. With few exceptions, the water table occurs in the overburden overlying bedrock with the saturated overburden ranging up to 21 m (70 ft). In general, the water table is encountered within several feet of the surface, adjacent to major water features and in incised ravines.

Groundwater flows in bedrock are controlled by hydraulic gradients, fracture networks, and karst solution features. Typically, bedrock flowpaths tend to follow geologic strike. Karst features are present in bedrock at ETTP, but conduit-dominated flow has been confirmed only in portions underlain by Knox carbonate along Blackoak Ridge.

The nearest domestic water supply wells are located approximately 3 km (2 miles) southwest of ETTP on the opposite side of the Clinch River. It is unlikely that these wells could be affected by groundwater flowpaths from ETTP, should such a pathway exist. Additionally, there are nearly a dozen domestic wells along Blackoak Ridge, west of the DOE boundary. Four of these wells were sampled recently and found to be uncontaminated.

3.4.4 Geology and Soils

In general, ETTP is underlain by bedrock that can be broadly characterized as carbonate (Chickamauga and Knox Group) or clastic (Rome Formation). The carbonates underlie the majority of the main plant area. The eastern part of the site is underlain by clastic bedrock of the Cambrian Rome Formation. The structural geology of ETTP is complex; the principal faults in the area include the White Oak Fault, a major regional thrust fault located along the south side of the ETTP. Seismic activity in the southern Appalachian Mountains that has affected the site area has been recorded 45 times since 1800. The probability of future seismic damage is moderate.

3.4.5 Ecological Resources

The ORR consists of diverse habitats and supports a rich variety of flora and fauna. Vegetation is characteristic of that found in the intermountain regions of central and southern Appalachia. Vegetation around the buildings within the fenced area on the ETTP proper is a mixture of mowed grasses with a few shrubs and trees. Many of the shrubs and trees have been planted as landscaping, although some native species are found in unmowed areas around ponds and waterways.

Since ETTP proper is planted primarily in nonnative grasses, it has very little habitat available for native animals except along Poplar Creek. The majority of animal species found within ETTP's boundaries are species that adapt well to disturbance and the presence of humans. There are no known federally protected plant or animal species on the ETTP site, although suitable habitat exists for the endangered bald eagle on Melton Hill Reservoir and the Clinch River. Sixteen plant species and 18 animal species that are considered rare, threatened, or endangered by the state of Tennessee are found on or near ETTP. However, the FWS notes that the federally listed endangered species—the gray bat (*Myotis grisescens*), the Indiana bat (*Myotis sodalis*), and the pink mucket (*Lampsilis abrupta*)—are known from, or have the potential to occur within, the project impact areas on the ORR.

The Lower Poplar Creek Rookery is the only environmentally sensitive area within ETTP. It is approximately 6.5 acres and is located on the north bank of Poplar Creek in the middle of the plant site.

3.4.6 Socioeconomics and Environmental Justice

Like the Y-12 Complex, ETTP is located on the DOE ORR, and the region of impact is identical to the ROI for the Y-12 Complex alternative. See Section 3.3.6 for summaries of population, income, and employment within the region. ETTP is in proximity to low-income populations on Blair Road (which runs behind the park).

3.4.7 Land Use

The approximately 1500 acres of land in the ETTP site are industrial. The site formerly produced enriched uranium using a gaseous diffusion process. Portions of the site have been used for waste storage since the facility ceased enrichment operations. Efforts are under way to convert existing buildings into productive use through reindustrialization.

3.4.8 Infrastructure

Treatment of domestic wastewater is performed at the ETTP Sewage Treatment Plant, which operates within a National Pollutant Discharge Elimination System permit. The operating capacity of the treatment plant is about 600,000 gal/day with a current load of half that capacity (DOE 1997c). The ETTP water treatment plant is currently producing from 800,000 gal/day to 1.4 mgd of potable water. Capacity of the system is roughly three times the current use. Highways in the area include State Routes 95 and 58.

3.4.9 Cultural Resources

The K-25 Site was established as part of the Manhattan Project to develop and produce HEU for use in nuclear weapons. The Manhattan Project created the first industrial process for separating uranium isotopes by the gaseous diffusion method. A summer 1994 cultural resources survey of the former K-25 Site identified a Main Plant Historic District with 120 contributing structures and 37 noncontributing structures, and 11 structures that are not contiguous with the historic district, that are eligible for inclusion on the NRHP (Sousa et al. 2001).

3.5 SAVANNAH RIVER SITE

SRS is located in southwestern South Carolina adjacent to the Savannah River, which forms the boundary between South Carolina and Georgia. SRS encompasses approximately 800 km² (300 mile²) within the Atlantic Coastal Plain physiographic province. SRS is approximately 40 km (25 miles) southeast of Augusta, Georgia, and 32 km (20 miles) south of Aiken, South Carolina. The site was constructed during the

early 1950s to produce the basic materials used in the fabrication of nuclear weapons, primarily tritium and ²³⁹Pu, in support of the nation's defense programs.

3.5.1 Human Health

The ROI population used in the Final Waste Management programmatic environmental impact statement (PEIS) to determine human health risk was 620,618 based on 1990 census data (DOC 1991). The radiation dose to a maximally exposed individual was 0.04 mrem for airborne radionuclides and 0.140 mrem for liquid releases (SRS 2001). In 2000, the collective radiological dose from airborne radionuclide emissions to the site ROI health risk population was 2.3 person rem (SRS 2001).

Releases of radioactivity to the environment from SRS account for less than 0.1% of the total annual average environmental radiation dose to individuals within 80 km (50 miles) of SRS (Arnett, Karapatakis, and Mamatey 1994). Standard population dose analyses for air releases are based on an 80-km (50-mile) radius, because expected dose levels beyond that distance are very small.

Worker doses at SRS have consistently been well below the DOE worker exposure limits. The all-pathway dose standard for site workers in 2000 was 100 mrem per year per DOE Order 5400.5 (SRS 2001).

3.5.2 Climate and Air Quality

SRS and surrounding counties are classified by EPA as attainment areas for all six of the NAAQS criteria air pollutants. The major sources of criteria air pollutants are nine coal-burning and four fuel oil-burning boilers, and the process facilities for fuel and target fabrication. Non-SRS sources of toxic air pollutants consist primarily of industrial installations, small manufacturing shops, and residual wood combustion.

Prevailing winds at the Bush Field Airport in 1992 are uniformly distributed, with winds from the west-southwest 7% of the time and from the west-northwest 6% of the time on a yearly basis. The highest occurrence of wind speed is 5 to 7 mph, with an annual occurrence of 35%. The annual average temperature is 66°F, with seasonal temperatures ranging from an average summertime daily maximum of 91°F to an average daily minimum in January of 38°F.

3.5.3 Water Resources

Major surface water resources include the Savannah River, which runs along the southwestern border of the site for 32 km (20 miles); on-site drainages such as Upper Three Runs, Fourmile Branch, Beaver Dam Creek, Pen Branch, Steel Creek, and Lower Three Runs; and numerous Carolina bays. No federally designated Wild and Scenic Rivers exist in the area. Groundwater wells and the Savannah River supply water for the site. On-site streams and the Savannah River receive treated wastewater. The 100-year floodplain does not encroach on existing facilities.

Major groundwater units are the interbedded sandy clays and clayey sands of the coastal plain sediments. The sandy beds generally form aquifers, and the clay rich beds act as aquitards. No sole source aquifers occur in the area.

In 2000, 24,806 radiological analyses and 125,924 non-radiological analyses were performed on groundwater samples collected from 1,188 monitoring wells. Various groundwater contaminants with estimated plumes have been identified in the A-Area and M-Area; C-Area; D-Area and TNX; the general

separations and waste management areas; K-Area; L-Area and chemicals, metals, and pesticides (CMP) pits; N-Area; and P-Area (SRS 2001).

3.5.4 Geology and Soils

The topography of the area is generally flat, with some rolling hills and knolls. Elevations range from 26 to 130 m (85 to 427 ft) above mean sea level. Major rock units include, from oldest to youngest, the crystalline basement rocks, the Dunbarton Triassic Basin, and the Atlantic Coastal Plain sediments.

Soils in the area are primarily sandy loams that occur on alluvial terraces of the Savannah River and on the Aiken Plateau. Several interbasinal faults are located in the down-faulted Dunbarton Triassic Basin. However, no conclusive evidence exists of recent displacement along any fault within 300 km (186 miles) of SRS.

Two major earthquakes have occurred within 300 km (186 miles) of the site. The probability of future seismic damage is moderate.

3.5.5 Ecological Resources

Major plant communities include cypress-gum and lowland hardwood swamps, sandhills, and old agricultural fields. Ninety percent of the SRS land cover is upland pine forest and bottomland hardwood forest. Important terrestrial habitats include old fields, sandhills, upland pine forests, bottomland and upland hardwood forests, and swamp forests. Longleaf pine/wiregrass communities support sensitive species, such as the red-cockaded woodpecker. SRS was designated a National Environmental Research Park (NERP) in 1972.

SRS contains approximately 43,000 acres of wetlands (20% of SRS), consisting of emergent marsh, cypress/tupelo, bottomland hardwood, and open water. These wetlands include the Savannah River Swamp (about 10,000 acres). More than 200 Carolina bays are scattered throughout the SRS.

The site provides refuge for several federally protected endangered or threatened species of plants and animals, including the red-cockaded woodpecker, the bald eagle, the smooth coneflower, the woodstork, the short-nosed sturgeon, and the pondberry (see FWS letter dated July 16, 2002, in Chapter 7). There are another dozen species which are listed as of special concern.

The SRS is one of the most biologically diverse areas in the southeast (<http://www.srs.gov/general/enviro/SRFS.htm>; April 24, 2002). There are 60 mammal, 107 reptile and amphibian, 80 fish, and 174 bird species on the site. Over 1300 species of vascular plants have been collected at SRS (<http://www.srs.gov/general/enviro/SRFS.htm>; April 24, 2002). The National Marine Fisheries Service has listed federally protected species also (see MNFS letter to DOE dated June 28, 2002 in Chapter 7).

3.5.6 Socioeconomics and Environmental Justice

The ROI for SRS includes Aiken, Barnwell, Allendale, and Bamberg counties in South Carolina and Burke, Columbia, Richmond, and Screven counties in Georgia. At least 90% of the states' employees reside in these counties. Table 3.3 summarizes population, per capita income, and total personal income from 1999 (U.S. Bureau of Economic Analysis 2002a). Total personal income for this eight-county region was more than \$11.5 billion. Total SRS site employment in 2002 is 13,800 (SRS Fact Sheet 2002).

The total population in the ROI in 1999 was 506,101. Population demographics include Native Americans at 0.2% and urban at 69.6%. Owner-occupied housing was 67.1% and renter-occupied 32.9%.

Sensitive populations include children under 15 years old – 23.7%, women of child-bearing age (15 to 44) – 24.3%, and adults over age 65 – 10.3%.

Table 3.3. Population and income in the Savannah River site region of influence for 1999

Region/variable	Population	Per capita personal income (\$)	Total personal income (\$ Millions)
South Carolina			
Aiken County	135,401	18,353	3,300
Allendale County	11,325	17,321	196
Bamberg County	16,289	18,606	303
Barnwell County	21,784	23,858	520
Georgia			
Burke County	23,217	16,386	232
Columbia County	93,312	22,931	2,140
Richmond County	190,310	23,980	4,564
Screven County	14,463	19,181	277

Three Native American groups, the Yuchi Tribal Organization, the Nubiunal Council of Muskogee Creek, and the Indian's People Muskogee Tribal Town Confederacy, have expressed general concerns about SRS and the Central Savannah River area regarding several plant species traditionally used in tribal ceremonies.

3.5.7 Land Use

The site occupies 198,000 acres of land, most of which serves as a forestry research center. SRS was designated a National Environmental Research Park (NERP) in 1972. Of the total area, approximately 15,840 acres are developed and 182,162 are undeveloped. Of the undeveloped land, approximately 145,400 acres are available for future site development. Land use surrounding the site is predominantly rural.

3.5.8 Infrastructure

On-site wells provide an average of 1.6 million gal of water per day. On-site treatment plants receive an average of 0.5 million gal of sewage per day. South Carolina Gas and Electric Company and on-site generation provide power. The current site load is 130 MW.

Transportation in the area consists of local access roads (such as U.S. 278 and State Route 125) and major roads (such as Interstates 20 and 95). The Seaboard Coast and Southern Railroads are the primary providers of rail service to the SRS region, including on-site rail spurs.

3.5.9 Cultural Resources

Native American population in the area began about 11,000 years ago. More than 800 prehistoric sites and about 400 historic sites have been identified at the SRS. Fifty-five sites have been determined eligible for the NRHP.

3.6 IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY

INEEL is a 2305-km² (890-mile²) DOE research facility located in southeastern Idaho. The physical and biological environment of INEEL and the region has been described extensively.

3.6.1 Human Health

Radiation in southeast Idaho in the vicinity of the INEEL consists of natural background radiation from cosmic, terrestrial, and internal body sources; manmade nuclear fallout; and radiation from consumer and industrial products. In 1997, INEEL activities added 0.03 mrem, 0.008% of background, to the maximally exposed individual's total EDE. These sources result in an estimated total EDE of 362 mrem/year to an average member of the public residing in southeastern Idaho (DOE 1998b).

3.6.2 Climate and Air Quality

The area surrounding INEEL is classified under the Clean Air Act of 1970 as a PSD Class II area, an area with reasonable or moderately good air quality that allows moderate industrial growth. To the west, about 19 km (12 miles), is the Craters of the Moon National Monument and Wilderness Area, classified as a PSD Class I Area.

The climate of INEEL has been studied extensively for many years. The National Oceanic and Atmospheric Administration (NOAA) operates 26 monitoring stations on or near INEEL. Detailed climatological information has been published by NOAA. Severe weather on INEEL consists of thunderstorms and funnel clouds. On average, two to three thunderstorms occur during each of the summer months. Small hail may accompany the thunderstorms, but hail damage has not occurred at INEEL. NOAA records indicate five funnel clouds and no tornadoes on INEEL since 1950.

3.6.3 Water Resources

Naturally occurring surface waters at the INEEL consist of three intermittent streams, the Big Lost River, Little Lost River, and Birch Creek. These streams drain adjacent mountain valleys and flow onto INEEL. All of the streams infiltrate, disappearing in the underlying aquifer. No surface water flows leave the INEEL.

Studies have shown that the projected 100-year flood of the Big Lost River on the INEEL would be adequately contained by the river channel with the utilization of an existing diversion area constructed near the point at which the river enters the INEEL (Bennett 1986). The flood control system was constructed on the Big Lost River in 1958. The system consists of a dam that diverts water into a series of spreading areas. In 1984, the dikes were raised so that the flood control system could contain a flood with an average return period of 300 years or more. In recent years, all of the water in the Big Lost River has been stored or diverted for irrigation upstream of the INEEL.

The Snake River Plain Aquifer is the principal groundwater feature in southeastern Idaho, underlying nearly all of the plain. Because groundwater supplies more than 50% of the drinking water consumed within the eastern Snake River Plain and an alternative drinking water source or combination of sources is not available, the EPA designated the Snake River Plain Aquifer a sole-source aquifer in 1991 (56 *FR* 50634, 1991). Aquifer depths within the INEEL range from 61 to 274 m (200 to 900 ft). This aquifer discharges approximately 8.0 billion m³ (6.5 million acre-ft) of water annually through springs and irrigation wells. Discharges from the springs contribute substantially to the flow of the Snake River.

3.6.4 Geology and Soils

The INEEL is on the Snake River Plain and is bordered on the north and northeast by the Lost River, Lemhi, and Bitterroot mountain ranges. Elevations on the INEEL range from 1585 m (5200 ft) in the northeast, to 1448 m (4750 ft) in the southwest.

The surface of the INEEL is relatively flat and composed of basaltic lava flows interbedded with sedimentary strata. A 30-ft layer of mixed sediments covers a deeper layer of underlying basalt. A grayish-brown gravelly silt loam, derived from loess mixed with alluvium from the Big Lost River, makes up the topsoil. Gravels occupy 50% to 75% of the surface area, and the erosion hazard is slight. The soil is moderately permeable, well drained, and generally nonalkaline. However, alkalinity increases with depth, and hardpan zones may occur at depths from 50 cm (20 in.) to 7 m (20 ft).

The INEEL is in a seismic zone 2B, defined by the Uniform Building Code (UBC) as an area where destructive earthquakes may occur. Extensive seismic evaluations have been performed for the INEEL. Numerous small earthquakes have been recorded in the region. Epicenters of most earthquakes have been in the surrounding mountains. In October 1983, a large earthquake (Richter magnitude 7.3) occurred 24 km (15 miles) northwest of Mackay, Idaho.

3.6.5 Ecological Resources

Flora and fauna of the INEEL have been surveyed and studied since the late 1950s. No substantial impacts caused by operation of INEEL facilities have been identified. Biological resources at the INEEL, in general, and Idaho Chemical Processing Plant (ICPP), in particular, are extensively described in DOE/EA-0306 (DOE 1991).

No species on the federal list of threatened or endangered species are known to permanently reside on the INEEL. No unique habitats are located on the INEEL.

No known endangered or threatened species nests in or inhabits the INEEL. However, the bald eagle (*Haliaeetus leucocephalus*), a federally-protected species, has been observed wintering on or near the INEEL (Martin 1995). The FWS, in addition, lists the Canada lynx, gray wolf, bull trout, Bliss Rapids snail, and the Ute ladies-tresses as species that may occur in the area (see FWS letter to DOE dated July 1, 2002, in Chapter 7). Several additional species are on the state of Idaho watch list, including the bobcat, ferruginous hawk, long-billed curlew, and merlin. A list of the most common species of animals found at the INEEL can be found in DOE (1998b).

3.6.6 Socioeconomics and Environmental Justice

The ROI for INEEL includes seven Idaho counties (see Table 3.4). Table 3.4 summarizes population, per capita income, and total personal income from 1999 (U.S. Bureau of Economic Analysis 2002a). Total population in the ROI in 1999 was 247,224, and total personal income for this seven-county region was almost \$4.9 billion. The average per capita personal income for the ROI was \$19,069.

Table 3.4. Population and income in the INEEL site region of influence for 1999

Region/variable	Population	Per capita personal income (\$)	Total personal income (\$ Millions)
Idaho			
Bannock County	74,881	20,252	1,516

Bingham County	42,127	17,321	742
Bonneville County	81,536	22,408	1,827
Butte County	3,012	19,376	58
Clark County	913	22,022	20
Jefferson County	19,949	16,947	338
Madison County	24,806	14,861	368

INEEL = Idaho National Engineering and Environmental Laboratory.

Employment at the INEEL rose steadily since the mid-1980s to a yearly average of approximately 12,387 [fiscal year (FY) 91]. However, employment in 1997 was 7,828 (DOE 2000) and is projected to decline to around 7,250 by 2004.

The majority of employees reside in Bonneville and Bingham counties east of INEEL. In FY 1991, an average of 8,500 employees commuted daily to INEEL facilities, primarily using the INEEL bus transit system.

The population surrounding INEEL is 7% minority and 14% low income (DOE 2000).

3.6.7 Land Use

The INEEL occupies 2305 km² (890 mile², 569,600 acres) in the southeastern Idaho desert. In addition to activities related to nuclear energy, the area has been designated as an NERP.

Developed facilities at the INEEL cover only a small portion (approximately 2%) of the total land area. Of the 550,000 acres of undeveloped land, approximately 330,000 acres are used for controlled grazing of cattle and sheep. The available area for future site development is approximately 22,330 acres.

3.6.8 Infrastructure

On-site wells and storage tanks provide an average of 5.242 million gal of water per day. On-site treatment facilities treat an average of 0.254 million gal of sewage per day. The Idaho Power Company supplies power, and the current load is 41.8 MW.

Transportation in the area consists of local access roads such as U.S. Routes 20 and 26. Interstate 15 passes to the east of the site and intersects Interstate 84 to the south. Rail lines, including an on-site spur connecting to the Union Pacific Railroad, also serve the region.

3.6.9 Cultural Resources

Several archeological and cultural resource surveys have been conducted in association with development (Reed et al. 1987). The only important site identified by these surveys was an historic homestead (Smithsonian Site # 10-BT-269). The site consists of a dugout shelter and associated historic debris characteristic of an occupation period between 1900 and 1930. The site is a considerable distance from any activity related to the proposed action and would not be affected by these efforts.

In the event that paleontological or cultural resources were encountered during subsurface activities, work would stop until a qualified professional assessed the significance of the resources.